

California State Polytechnic University, Pomona

Chem 316
Midterm Exam
Winter, 2007
Beauchamp

Name: _____

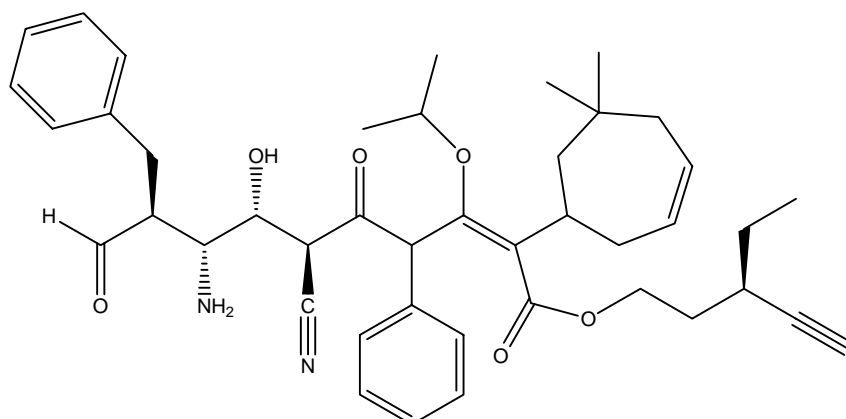
Topic	Total Points Exam Points	Credit
1. Nomenclature (1)	25	
2. Arrow-pushing Mechanism and explanation	24	
3. Reactions page 10 x 3 lines of reactions studied so far in organic chemistry	30	
4. Tautomers (one in acid and one in base)	30	
5. ¹⁴ C synthesis (methanol, ethene, cyclohexene, propene, bromobenzene, NaCN, CO ₂ , ¹⁴ C compounds)	25	
6. Synthetic targets using techniques learned thus far (prepare 9 target structures, 18 to choose from)	45	
Total	179	

This is a long exam. It has been designed so that no one question will make or break you. The best strategy is to work steadily throughout the period, starting with those problems you understand best. Make sure you **show all of your work**. In mechanism problems, draw in any lone pairs of electrons, formal charge and curved arrows to show electron movement. If resonance is present in a mechanism problem, draw at least one additional resonance structure to show you recognize this feature (make sure the "best" resonance structure is included in your two resonance structures). Only write answers on the front of each page. Do your best to show me what you know in the time available.

Be curious always! For knowledge will not acquire you; you must acquire it.

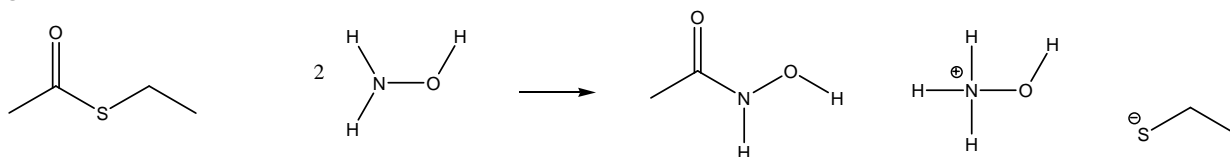
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1. Provide an acceptable name for the following structure. (25 pts)

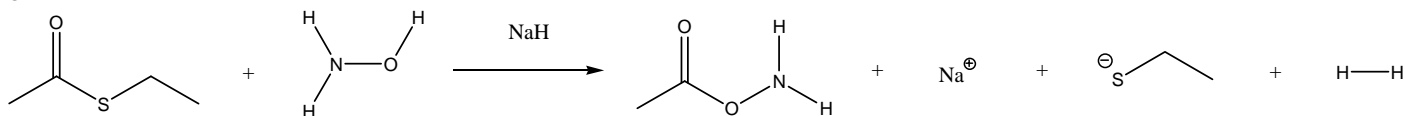


2. Explain why the following reactions react differently. Provide complete arrow-pushing mechanisms for both of the reactions. Include curved arrows, lone pairs of electrons and formal charge. If resonance is important to your solution, draw at least one additional resonance structure to show you recognize this feature. (20 pts)

a.



b.

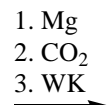
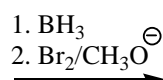
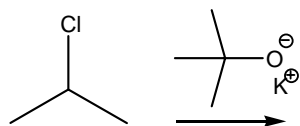


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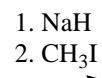
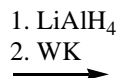
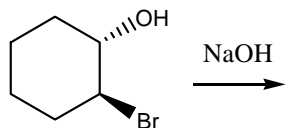
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3. Provide the expected product for each of the following transformations. Show regiochemistry and stereochemistry clearly, if relevant. Do NOT show mechanisms. (30 pts)

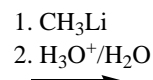
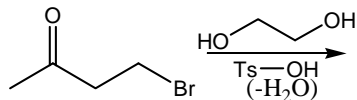
a.



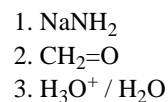
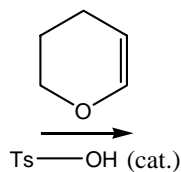
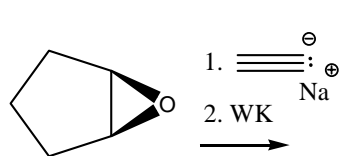
b.



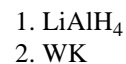
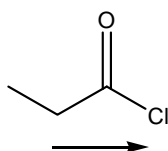
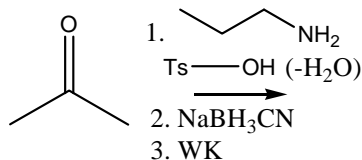
c.



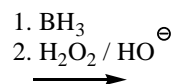
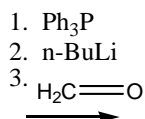
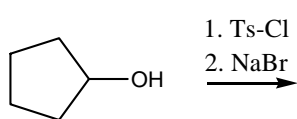
d.



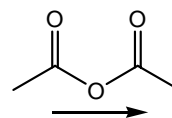
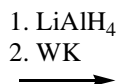
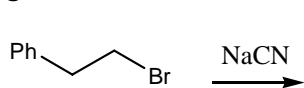
e.



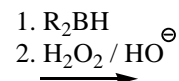
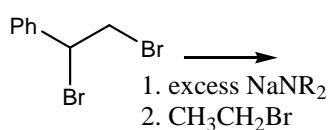
f.



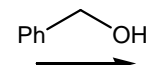
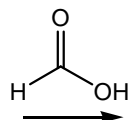
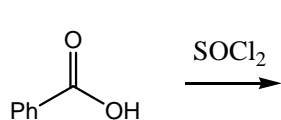
g.



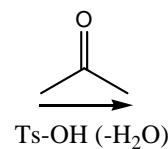
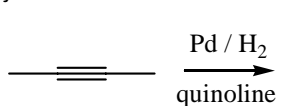
h.



i.



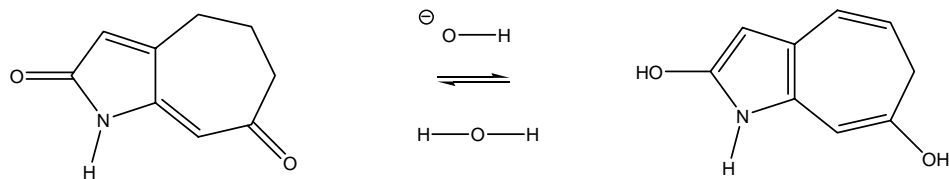
j.



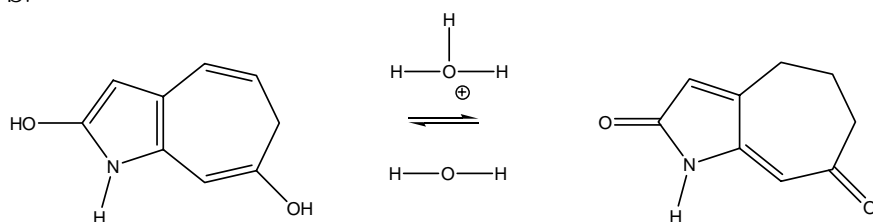
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4. Provide complete arrow-pushing mechanisms for the reaction below. Include curved arrows, lone pairs and formal charge. If resonance is present, draw at least one additional resonance structure to show you recognize this feature (make sure the "best" resonance structure is one of your two resonance structures). (30 pts)

a.



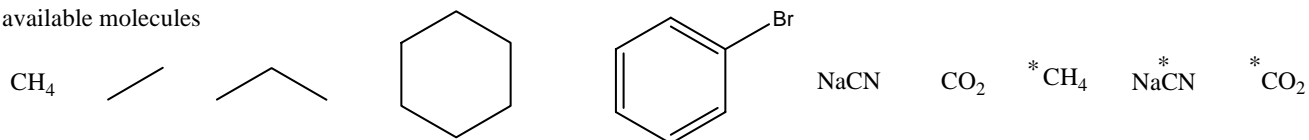
b.



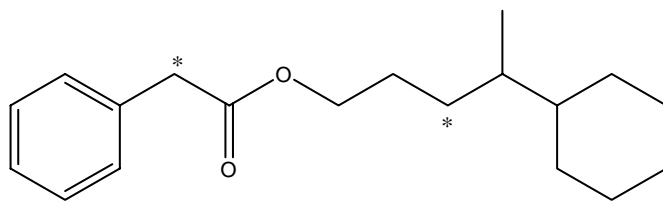
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5. Propose a synthesis for the following compound using methane, ethane, propane, cyclohexane, bromobenzene, sodium cyanide or carbon dioxide. Your only source of radioactive ^{14}C carbon is ^{14}C methane, $^*\text{CH}_4$, carbon dioxide, $^*\text{CO}_2$ and sodium cyanide, Na^*CN . You may also use any typical organic reagents. Often the best strategy is to work backwards from the target molecule. The last step of the synthesis should be your first step. Show the reagents and reactant for each backwards step until you reach allowable starting molecules. Do not show mechanisms. (25 pts)

available molecules



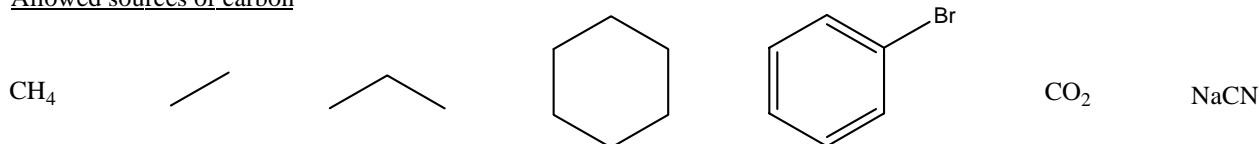
target structure



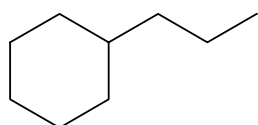
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6. A key reagent or name is mentioned with each target molecule below. You can use any acceptable approach to make the target structure you like, but you must use the reagent or name reaction someplace in your proposed synthesis. Once a molecule is made in any of the syntheses, you do not need to make it again. Just refer back to the part where you originally made it. You can choose up to 9 target structures to make, placing you proposes syntheses in the work areas on the following 2 pages. Work backwards (retrosynthetic thinking) and show each intermediate structure and each reagent until you reach an acceptable starting point. Acceptable starting points are the following structures and any routine reagents we have discussed in the course. Mechanisms are NOT required. (45 pts)

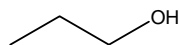
Allowed sources of carbon



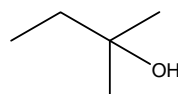
Target structures and reagents / terms:



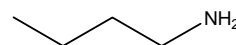
- a. use a cuprate
b. use the Wittig reaction



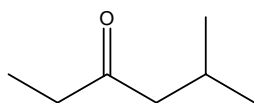
- c. use lithium
d. use an alkene



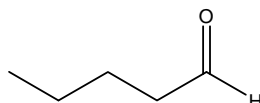
- e. use an alkyne
f. use an ester



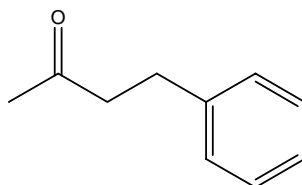
- g. use cyanide
h. use the Gabriel synthesis



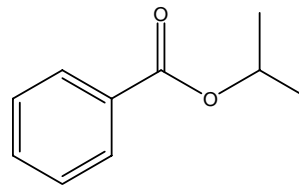
- i. use a cuprate
j. use a nitrile



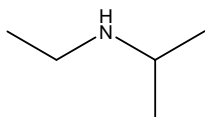
- k. use an epoxide
l. use cyanide



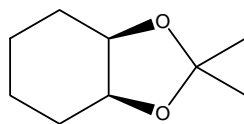
- m. use an enamine
n. use an alkyne



- o. use CO_2
p. use a primary alcohol



- q. use an imine



- r. use the Jones reaction

Synthesis 1

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Synthesis 2

Synthesis 3

Synthesis 4

Synthesis 5

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Synthesis 6

Synthesis 7

Synthesis 8

Synthesis 9

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Those who wish to sing always find a song. Swedish